Environmental and Safety Issues for Drillers

The Environment

MODERATOR
Jean Chevalier
Sedco Forex
Aberdeen, Scotland

As I'm sure we all agree, environmental issues are occupying center stage in our industry. Tip, could we start by hearing your company's viewpoint on this issue?

TIP MURREL
Conoco is serious about exceeding the established requirements. We are a core company of the DuPont organization, which is actively moving to exceed all existing regulations, requirements, demands or anything else regarding the environment. It's going to cost money.

WILL LOWE
That's exactly the approach we take at Chevron. If we can't comply with the rules and regulations to protect the environment, we just don't do the work. This trend has permeated our organization.

JOHN MOGFORD
I think everybody has realized that safety and preserving the environment saves you money as well. We're pushing standards up not just because the CEO says "I want BP to be green," but because it's worth money to us. We also recognize that you've got to increase the awareness of the men on the rig floor. To that end, we've introduced bonuses in the North Sea allied to environmental matters. We award a monthly bonus to our rigs with no lost time accidents or no environmental incidents. If there's any oil spill or cuttings going over the side unnecessarily, then the bonus is withheld from the crew.

MODERATOR
And who is the referee?

MOGFORD
The referee is the operator—it's our money. But there is no incentive for us not to pay it. If we didn't want to pay, we wouldn't put this type of clause in the contract. It's over and above the normal rig contracts and the intent is that it goes direct to the crews.

MIKE PARRISH
That's the reward. But is the industry training its work force in environmental protection?
ROGER COLMER
We certainly are in Shell companies. We've taken steps in the last few years to produce some functional guidelines on environmental matters. Before we go into a new exploration area, we undertake an environmental baseline study, and then the manager of that operation at least knows where he's starting from. He's accountable for any negative environmental impact during that operation. During annual staff appraisals, we also make it clear that environmental awareness and performance is part of each employee's responsibility.

Providing formal training is not easy. It often starts with a moral judgment. To achieve environmental goals, you need corporate guidelines and standards.

MURREL
We have an annual President's Award, given to an individual or group considered to have made the greatest contribution to the environment. This has been going on for about five years and has come to be very coveted.

During 1989, considered for the President's Award was our New Orleans division which organized a beach cleanup campaign that included every member of the working force in that particular operation. They did a similar thing in the Rocky Mountains near one of the game parks. But the Humber Refinery in England was the winner. The people at that refinery created their own game park. The government furnished the land and the people furnished the work and purchased the animals. I have visited the area—it's a unique experience to go into the Humber Refinery and see the beautiful setting they've created.

MICHEL TEXIER
For many years Elf has been very concerned about environmental matters and has taken appropriate action to successfully develop the Zuiderwal field in Holland—in a very sensitive area, and also to drill one well in the city of Paris.

Oil-Base Mud

MODERATOR
Let's focus on the question of oil-base mud and cuttings treatment and discharge. I'm told that in the North Sea today if we had to go back to water-base mud, drilling would cost 40 percent more. How do you feel about oil-base mud and its possible replacement with water-base mud?

LOWE
I think that banning of oil-base mud is inevitable. There's just too much public furor about it, about oil discharge in general.

MOGFOORD
Yes, I agree. We may be allowed to continue using oil-base mud for a year or two, maybe five years. And I think the industry has not been as active as it could in developing alternatives to oil-base mud. So far, we've been fighting a rearguard action.

LOWE
A problem for us is the tremendous penetration rates with oil-base mud, particularly in combination with PDC2 bits. And there are situations where you just can't get there without using oil-

1. The International Association of Drilling Contractors (IADC) is an organization of 465 drilling contractors designed to improve the exchange of technological information and improve drilling operations worldwide.

The Society of Petroleum Engineers (SPE) is an international professional association of more than 50,000 engineers, scientists and managers involved in the exploration and production of hydrocarbons and geothermal resources.

2. PDC: Polycrystalline diamond compact.
base mud—platforms with shallow horizons where you have to go out ten, eleven or twelve thousand feet to get to the pay. The question is: Are there going to be some wells that you won’t be able to drill with current water-base technology?

**MOGFORD**
The real cost implications of water-base mud are not in drilling, but in production. In the North Sea with current water-base muds, you get half the drainhole length in a horizontal well than if you use oil-base mud. And that represents a quarter of the drainage. Water-base mud delays production and requires additional satellites and additional jackets. Eliminating oil-base mud could kill a lot of potential North Sea developments.

**COLMER**
Shell companies recently drilled two horizontal wells using water-base systems, one in West Africa and the other in the Middle East, and found that preconceived notions about needing oil-base mud to drill horizontal wells are not necessarily true. With some careful engineering of the bottomhole assembly and the overall design of the well trajectory, we believe that you can drill horizontal wells quite successfully with water-base fluid.

**MODERATOR**
That depends on lithology ...

**COLMER**
Yes, and the length of horizontal drainhole you want to drill. But it looks as though we could be bolder and not always insist, particularly from an environmentally and well control point of view, on oil-base mud.

**MODERATOR**
Don’t you think someone will develop the technology to treat oil-base mud cuttings? Conoco has tried and has put money on cuttings treatment, deoil the cuttings ...

**MURREL**
Yes, we have. We certainly are working toward making drill cuttings inert, but that process has some way to go.

**STAN CHRISTMAN**
How about fluid discharge from the solids control equipment? I hear a lot about cuttings cleaning, but we’re still left with oily discharge from other equipment. Do you barrel those up and haul them ashore?

**COLMER**
Shell Explo in the North Sea experimented with putting a dedicated technician on board just to track every barrel of oil-base mud. By having him on board, they made a significant reduction in wastage. Before, there was always leakage through the mud treating equipment or slopping over the top of the mud ditch. The savings from this housekeeping offset to some extent the cost of the technician.

**MOGFORD**
We’ve been looking at superwetters to strip off the oil, advanced cuttings cleaning techniques, etc. I think everybody’s going to carry on and hope that something materializes. But I’m fairly pessimistic on that particular point.

**COLMER**
Given that pessimism, we have to look at water-base mud and different well designs. Maybe it’s going to cost us a bit more money. But if we are dedicated to the maintenance and improvement of the environment, there is going to be a price.

**MODERATOR**
Do you think the industry is doing enough to improve water-base mud technology? When you look at the money spent annually on kick related issues and mechanization and compare it with the replacement of oil-base mud, I think it looks a little bit unbalanced.

**COLMER**
Yes, it’s also small compared with the money spent on cuttings cleaning equipment and other systems on some of the larger North Sea platforms. They’re talking about a crew of two or three people just to run cuttings cleaning equipment. And still, at the end of the day, they are left with slightly oily cuttings or wash fluids they really can’t dispose of.

**MODERATOR**
Are each of your companies developing new water-base polymers in house?

**MOGFORD**
I know there’s a few million being spent around this table on water-base mud drilling research.

**MURREL**
Each of the companies is definitely spending research money, in some cases large quantities of money, for an improved water-base fluid. Unfortunately, we’re not there yet, at least not in my company.
TEXIER
Elf has been working since 1987 on nonpolluting formulations to replace oil-base mud. Today we are in the process of qualifying new formulations, and also to study new concepts in cooperation with a major mud company.

MOGFORD
There may be a critical period in the next few years, before water-base muds improve, where we will lobby against a total ban on oil-base mud.

MODERATOR
You don’t think the solution is to keep oil-base mud but bring everything back to shore?

MOGFORD
We studied bringing cuttings ashore in Norway, but the cost outweighed the whole advantage of using oil-base mud. But there are alternatives. There’s annulus disposal which has been used in Alaska and the Gulf of Mexico—we’re field testing it now.

In limited cases, perhaps for one small section of the reservoir where you absolutely need oil-base mud. I can see you might get into hauling cuttings away. But it depends where you are. In Europe, the cost of onshore disposal of oily cuttings is prohibitive, whereas in the US, it’s a viable alternative.

Shell companies recently drilled two horizontal wells using water-base systems, one in West Africa, the other in the Middle East, and found that preconceived notions about needing oil-base mud to drill horizontal wells are not necessarily true.

MURREL
On our latest deep water platform in the Gulf of Mexico, we used oil-base mud for development and the cuttings were all transferred to the shore.

MODERATOR
Nevertheless, you all believe that one day water-base mud will take over?

MOGFORD
I think if we stand back from the drilling business, we’ve got to say ultimately it’s good if oil-base mud discharge is eliminated.

Safety

MODERATOR
Let’s shift now to safety in drilling operations.

COLMER
At the Wednesday luncheon, Ric Charlton made an interesting statement that safe business is good business. Companies with good safety records normally run other parts of their business very well.

CHRISTMAN
I think the statistics in recent years—IADC captures them—show a good trend.

MURREL
Does anyone here see the situation reversing with increased rig activity? I believe the potential’s there, but I don’t really see it coming back to its previous level. Obviously, if you increase rig activity and you’ve got new people who are less qualified, the situation may get worse.

COLMER
It’s encouraging to hear people like Jim Day say they’re putting extra men on crews to take care of that contingency, so that when the business does turn up again—as I’m sure it will—there will be enough trained people.

MURREL
We also heard him say that operators should pick up the tab, which they’ve been doing.

COLMER
If safety is that important, then all of us have to pay for it. If the drilling contractor says “I need this extra man” and can frame it in terms of safety awareness and safety management, then as operators we must share the financial responsibility.

MURREL
On your Sedco Forex rigs, where is the most unsafe area? Is it the drill floor?

PARRISH
Our IADC safety statistics say it’s off the drill floor, on the pipe rack and around cranes—handling cargo under the crane.

MURREL
That’s also true on Conoco’s platforms. To improve safety, we should be spending a hundred percent of our money making it safer moving things between supply boats and the platform.

MODERATOR
That brings us to mechanization. One of the key arguments behind rig mechanization is safety. What do you think about that?

CHRISTMAN
I don’t think mechanization will guarantee safety. If there is insufficient safety emphasis in its design, mechanization will just change the type of accidents. Ultimately, safety comes from how you manage your rig and the safety attitude of the organization.

4. The improvement can be seen in a six-year summary of the number of lost-time accidents per million man-hours, compiled by IADC:

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<tr>
<td>1989</td>
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</tr>
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5. James C. Day of Noble Drilling Corporation and current chairman of IADC gave an address at the 1990 SPE/IADC meeting.
The mechanization projects Shell companies are working on include the prepackaging of tubulars. They're assembled in a cassette, for want of a better word, one unit to be handled rather than a lot of small irregular lifts. That is bound to impact safety in handling.

A number of studies show that by simply removing personnel from the drill floor where there are rotary tongs swinging around on cables, you reduce the potential for accidents.

**Kick Detection**

**MODERATOR**

Another key safety issue is kick detection. Thirteen percent of the papers at this conference address kick detection, kick control and kick equipment. And last year, 1989, was a catastrophic year with rig losses because of kick disasters. What is going to happen? How do you see the evolution of technology for kick detection and control?

**MOGFORD**

You can split it into two areas, what happens downhole and what happens at the surface. I think we should be looking more at how downhole sensors can indicate influxes into the wellbore. There's got to be a lot more work on surface sensors, pit-level detections and flow shows. As far as I know, the only new sensor developed in the past ten years is Anadrill's new flow-out measurement.6

**COLMER**

I agree. But in addition to faster kick detection, we need more accurate kick detection. Also, we're seeing a general trend towards smaller hole sizes. The detection of influxes into a slim hole is absolutely crucial.

**CHRISTIAN**

We must also improve on understanding the dynamics of kicks—gas migration, dispersion and solution—and in developing systems that put this understanding on the rig floor. This will show the rig crew what's happening during a kick, to help them handle the kick effectively. It can also help them from being too conservative when there really isn't a serious problem.

**TEXIER**

Around 1985, we developed a gas kick warning device which, in my opinion, is a valuable tool. But marketing it to the field has not been successful. What we are trying to do now is use seismic technology to predict formations to be drilled, in particular to find formations with abnormal formation pressures.

**MURREL**

Our present strategy is in-house training of company and contractor personnel. In 1990, we purchased a well control training simulator which we will be using worldwide on the drilling rig. Up to now, we've used a semiportable simulator that we take around the world but not to the drilling rig. I'm very positive about this because we're going to have a lot of new people enter the drilling field in the next few years, and these people must be brought up to speed.

In general, we believe—and I certainly do, as one of the older drillers—that two mistakes are commonly made. First, you believe every piece of data coming off a sensor, forgetting that the data may be incorrect. Second, once you see a piece of data that is incorrect, you disbelieve all data coming off all sensors.

I don't think rig mechanization will guarantee safety. Ultimately, safety comes from how you manage your rig and the safety attitude of the organization.

**COLMER**

I agree that training is important. How many times do we read in well control books and training manuals: "Strip it into bottom"? Three small words, but if you've never done it before and you've got a lot of pressure underneath you, it is certainly a very difficult exercise. One of the Shell companies in the Netherlands has invested in a full-size training facility consisting of a well 1500 meters [5000 feet] deep, where we can actually train people in those procedures.

**LOWE**

We have a similar facility at our drilling technology center in Houston to teach stripping and snubbing, actually live well control.

**MODERATOR**

Coming back to the question of kick detection, do you believe that the slimhole or shallow gas kick problems merit a kind of automatic detection and closing of the well?

**COLMER**

There's a big psychological barrier there. I think we have to go through a phase of semiautomatic control. The advent some fifteen years ago of the semiautomatic choke for circulating a kick out gave people a feeling for automation. But to my knowledge, I don't think anyone's killed a well on full instrumentation.

**MOGFORD**

I don't know anybody who even uses an automatic choke.

**COLMER**

I think automatic control is nevertheless important because of the boredom factor during well killing operations. After the initial kick and the adrenalin has been flowing and the well is secured, relaxation creeps in. It's a deep well and you've got large volumes of fluid, a kill can take quite a long time. People start losing interest—you may get a shift change. There have been several cases where relaxation has led to a second influx.

**Regulatory Agencies**

**MODERATOR**

Let's move to the role of governmental regulatory agencies. How do you see forthcoming regulation and the oil industry's relationship with regulatory agencies?

**MOGFORD**

After each major incident, there's about a year when a lot of new regulations come in, and then all goes quiet. In many instances, regulatory agencies are reactive, not proactive. There is a perception that they legislate on past problems or catastrophes.
COLMER
Perhaps that’s where oil companies together with the major drilling contractors have a responsibility to be more proactive, rather than waiting for the next disaster.

MURREL
With our last two high pressure wells in the North Sea, the regulatory agency focused on two details. The first was whether the elasticity of subsea wellhead seals was sufficient for the cold waters of the North Sea. The second concerned requirements for manufacture of blowout preventers. Manufacturing specifications for these rather large devices come nowhere near the normal manufacturing requirements for production valves. I believe the regulatory agencies will insist on raising the standards.

CHRISTMAN
Do you see them requiring performance testing too?

MURREL
I believe they will. The first thing we’ll see is X-ray analysis of the seal bodies and then definitely tighter elasticity controls. In deepwater drilling, we’ll also see a tighter time requirement for signal valve sealing.

MOGFORD
We have to understand more where the regulatory agencies are coming from. We’ve tended to drift apart. I know both Shell and BP have had productive exchanges with the UK Department of Energy. We’ve brought Department of Energy people to our operation for a year or so and put our own operations people to work as inspectors. That has helped break down some of the barriers. Instead of a letter formally issuing a ruling, it’s now a phone call: “Hey, why are you doing this?”

In general, we believe that two mistakes are commonly made. First, you believe every piece of data coming off a sensor, forgetting that the data may be incorrect. Second, once you see a piece of data that is incorrect, you disbelieve all data coming off all sensors.

MOGFORD
Drilling contractors have only just started exercising their ability, through IADC, to comment on some of the new regulations. I attended a joint IADC/MMS meeting last week. MMS was definitely happy to be meeting with the drilling community.

COLMER
Agencies are going to tighten up a lot more on language used to define requirements. We’re going to see terms like “must be adequate” or “must be sufficient” get much more specific. In addition, depending on which geographical area you’re operating in, a fairly detailed and engineering-based well program will have to be submitted for each operation.

MURREL
Do you believe the increased paperwork makes a safer operation?

MOGFORD
In some cases, yes—for example, the push in the early 80s for manufacturers’ documentation.

COLMER
I don’t think you can automatically say that more bureaucracy means more safety. But it’s encouraging that when you pick up a piece of equipment, it’s got a data sheet, material traceability, heat treatment records and the chemical composition.

MOGFORD
Some of the paperwork stops people thinking. People just automatically comply and feel that whatever is being regulated is then guaranteed to operate safely.

MODERATOR
But sometimes the paperwork makes you think—it may make you realize you are not complying.

MOGFORD
Every company has a different philosophy on how much policy and paperwork it should impose on the man on the rig. We all have different feelings, and that’s obviously going to be the same with how much paperwork we think the regulatory bodies should enforce.

—HINE

6. Anadrill’s Accu-Flow* sensor.
7. Strippling describes the emergency technique of lowering drillpipe through closed BOPs.
8. Automatic chokes are used on the mud flow line to control circulating pressure while controlling the well.
† Mark of Anadrill